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ical (F) and Anthropological (H) Sections. The speaker dwelt especially on anomalous spines of the vertebral column.

The Fauna of Cold Spring Harbor. By DR. C. B. DAVENPORT.

GAVE a general account of this station, a description of which will be published later in this JOURNAL.

Naples Station: General Description and Notes on Methods of Work Employed There. By DR. E. O. HOVEY.

THIS laboratory was established in 1872, by Dr. Anton Dohrn. Although some thirty stations have since been established on similar lines, this has maintained its lead in importance. The most popular feature is the aquarium, which consists of 26 tanks (described in some detail). The chief function is investigation, which is carried on by a corps of nine regular officials, and 30-40 students from all parts of the world. More than 1,000 men have studied at the Laboratory. An important feature is the beautiful preparations of the Naples marine fauna, which are sent to museums and investigators all over the world. The paper presented many interesting and practical details of methods employed.

General Statement of Types and Figured Specimens of Fossil Invertebrates in the American Museum of Natural History. By DR. E. O. HOVEY.

THE Museum has at least 8,000 types and figured specimens of fossils. A large part of these are in the James Hall collection, including a large proportion of species of the New York Palæozoic horizons; also important series from Waldron and Spergen Hill, Indiana; Racine, Beloit and other localities in Wisconsin and Minnesota. The Museum has the F. S. Holmes collection, including many Tertiary and Post-Tertiary types from South Carolina; the types of Hall and Meeky from the Cretaceous of Nebraska and many types of species de-

scribed in the Bulletin of the Museum. In the paper a number of other lots of types and figured specimens are mentioned which cannot be referred to in this brief abstract.

Ink and Paper for Museum Labels. By DR. ROBERT T. JACKSON.

DWELT on the importance of carbon writing and rubber stamp inks, as being the only inks suitable for permanent records. Bond or linen record paper advised as being lasting. Ordinary paper not suitable for permanent records. This paper will be published in this JOURNAL.

ROBERT TRACY JACKSON,
Secretary of Section F.

NOTES ON PHYSICS.

SECTION B AT THE BOSTON MEETING.

THE program of Section B contained fifty titles of papers, forty of which were read in full. Many of these papers were of high order and almost every one was creditable and interesting. The increasing activity of Section B and its growing membership are matters for congratulation, and it is probable that an affiliated American Physical Society may soon become desirable and feasible. The proceedings of Section B will be reported in SCIENCE at an early date.

THE FLOW OF WATER IN PIPES.

THE flow of water in pipes and channels is again the subject of elaborate investigation,* but it is doubtful whether anything more than roughly approximate formulation of the laws of flow of water can ever be reached. It seems that the slightest roughness on the inside of a pipe leads to *unstable states* of fluid motion resulting in the formation of eddies. If incipient eddy motion is indeed an unstable state of fluid motion—and our knowledge of vortex sheets, such, for example, as the air jet of an organ pipe, seems to show that it is—then the flow of

* Paper by G. H. Knibbs, Journal and Proceedings of the Royal Society of New South Wales (XXXI.).

water in anything but a mathematically smooth pipe *cannot be rigorously treated by any of the methods of rational mechanics*, for the very troublesome characteristic of all unstable states of a system is that subsequent aspects of the system are *influenced to a finite extent by infinitesimal initial causes*. The flow of water in a pipe is, in its details, about as difficult to rationalize as the weather.

THE SYNCHRONOGRAPH.

PROFESSOR A. C. CREHORE and Lieutenant G. O. Squier have devised means for using individual pulsations of a sinusoidal alternating current for signalling in high-speed telegraphy. Their Synchronograph, as the instrument is called, has been tried by the inventors on some of the lines of the British Post Office, and the results show that the Synchronograph is capable of transmitting words from three to seven times as fast as the Wheatstone apparatus at present in use.

SCIENCE ABSTRACTS.

A NEW periodical of the above title is now being published under the direction of the Physical Society of London and of the British Institution of Electrical Engineers. This journal aims to give a complete abstract of current literature in physics and electrical engineering. It certainly has good reason to be, and it will no doubt prove to be of great usefulness to English-speaking physicists and engineers. The abstracting of (foreign) physical papers in the Proceedings of the Physical Society is discontinued.

CATHODE RAYS.

SIR WM. CROOKES' original hypothesis that cathode rays consist of rapidly-moving, negatively-charged particles is proving to be increasingly useful in leading to and interpreting new experiments. Lenard* has recently measured the variations of velocity of cathode rays, which are produced when the rays pass parallel to the lines of force

in an electrostatic field—a field independent from that which produces the rays. These measurements were made by observing the deflection of the rays by a magnetic field. The velocity of the cathode rays, calculated from the observed deflection, ranges from $\frac{1}{10}$ to $\frac{1}{3}$ of the velocity of light. These variations of velocity were also clearly indicated by observed variations of the deflection produced when the altered cathode rays were passed at right angles to an auxiliary electrical field, though the author did not calculate the various velocities in this case from the observed electrostatic deflections.

Merritt* has shown that cathode rays reflected from a platinum obstacle have the same velocity as the incident rays—that is, to say the reflected and incident rays are equally deflected by a magnetic field. If the moving particles in the cathode rays are about $\frac{1}{1000}$ as massive as hydrogen molecules, as has been pointed out by J. J. Thomson, then these particles should show but little diminution of velocity after impact with platinum molecules, and corresponding to this the reflected and incident rays should be equally deflected by a magnetic field.

THE ELECTROCHEMICAL EQUIVALENT OF SILVER *vs.* THE MECHANICAL EQUIVALENT OF HEAT.

ROWLAND'S value of the mechanical equivalent of heat, reduced by W. S. Day† to the Paris hydrogen temperature scale, is distinctly different from the value of this equivalent as determined electrically by Griffiths and by Schuster and Gannon. The electrical method involves the electrochemical equivalent of silver, inasmuch as the measurement of current was carried out in these experiments by means of the silver voltameter. A redetermination of the

* Paper read before Section B at Boston.

† *Physical Review*, VII., 193.

* Wied. Ann., Vol. 65, p. 504.

electrochemical equivalent of silver by Patterson and Guthe,* under a grant from the American Association, brings Griffiths' value for the mechanical equivalent of heat into coincidence with Rowland's value. This work of Patterson and Guthe is of the greatest importance and is greatly to the credit of the American Association Committee on Standards of Measurement.

W. S. F.

CURRENT NOTES ON METEOROLOGY.

PAPAGUERIA.

SINGULARLY emphatic is the control exercised by the climatic conditions in the arid region of southern Arizona over the animal and vegetable life that is found there, as is shown by McGee in a recent article on 'Papagueria' (*National Geographic Magazine*, August). The district inhabited by the Papago Indians, south of the Gila river and southwest of the Sierra Madre and bounded on the southwest by the Gulf of California, is extremely arid. The scanty vegetation is fitted for its peculiarly difficult struggle for existence by being pulpy in structure and having impervious rinds for preserving moisture, as well as by being provided with thorns. The animals are armed with mandibles, stings, poison glands and other protective devices. In order to carry on the struggle for existence as successfully as possible, animal and vegetable life associates itself in communities, where grasses, trees, cacti, insects, reptiles, birds and mammals live together in harmony and mutual coöperation. The most interesting control of the climate is naturally that over man. The keynote to the understanding of the life and habits of the Papago Indians is to be found in the climatic conditions. The semi-nomadic life of the greater portion of the tribe; the building of their rude huts in the vicinity of permanent or temporary

springs; the absolute dependence of the times of planting and of harvesting upon the storms or freshets; the migrations southward and northward with the coming on of summer or winter—in these and in many other ways climate is seen to be the great control in the life of the people. As the writer strongly emphasizes at the conclusion of his extremely interesting paper, "the life of the Papago is a round of migrations and wanderings, largely in search of the means of subsistence, of which the first and the second and the third are water, *water*, WATER—water to alleviate his own thirst in the sun-parched deserts, water to sustain his horses and burros and kine, water to vivify the plants of which man and his creatures eat."

TREE PLANTING ON THE PLAINS.

A NUMBER of points of meteorological interest are found in Bulletin No. 18 of the Division of Forestry, entitled 'Experimental Tree Planting in the Plains,' by Charles A. Keffer, Assistant Chief of the Division. The experimental tree plantings described in this report were begun in 1896, in South Dakota, Nebraska, Kansas, Colorado, Minnesota and Utah. Protection, then amelioration of climate, is the principal object of the plantings, a wood supply being a secondary consideration, for the growing of timber on a commercial scale on the Plains is hardly to be expected. That a lack of sufficient moisture is the cause of the treelessness of the Plains has often been claimed, but many artificial plantings are now growing successfully in what was a few years ago a treeless region. A study of the climatic and soil conditions, and the results of the experiments, lead to the conclusion that the line of successful tree culture will move westward as the agricultural development of the country goes on, and as the soil is more and more broken up and disintegrated. The preva-

*Reported to Section B at the Boston Meeting.